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Title: “The Time Evolution of Eta Carinae’s Colliding Winds”

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Abstract:

We report new HST/STIS observations that map the high-ionization forbidden line emission in the inner arcsecond of Eta Car, the first that fully image the extended wind-wind interaction region of the massive colliding wind binary. These observations were obtained after the 2009.0 periastron at orbital phases 0.084, 0.163, and 0.323 of the 5.54-year spectroscopic cycle. We analyze the variations in brightness and morphology of the emission, and find that blue-shifted emission (-400 to -200 km/s) is symmetric and elongated along the northeast-southwest axis, while the red-shifted emission (+100 to +200 km/s) is asymmetric and extends to the north-northwest. Comparison to synthetic images generated from a 3-D dynamical model strengthens the 3-D orbital orientation found by Madura et al. (2011), with an inclination  $i = 138$  deg, argument of periapsis  $w = 270$  deg, and an orbital axis that is aligned at the same PA on the sky as the symmetry axis of the Homunculus, 312 deg. We discuss the potential that these and future mappings have for constraining the stellar parameters of the companion star and the long-term variability of the system. *Plain-Language Abstract:* With HST, we resolved the interacting winds of the binary, Eta Carinae. With a 3-D model, we find the binary orbit axis is aligned to the Homunculus axis. This suggests a connection between the binary and Homunculus ejection mechanism.